

Chapter 3

Input/Output Devices

Input and output devices enable computer to interact with the external world. User can enter data and instructions into the computer with the help of input devices. Whereas computer after processing the data, sends the results back to the output devices. The input can be given in variety of forms e.g. text, image, voice etc. Similarly output may be required in different forms depending upon the user's requirements. That's why a number of different types of input and output devices are available.

3.1 Input Devices

The devices which are used to enter data and instructions into the computer are called input devices.

The most commonly used input devices are:

- Keyboard
- Mouse
- Microphone etc.

Before data processing, data and instructions must be entered into the computer through some input device. The input device converts data and instructions into a form that a computer can process. The computer can process millions of instructions in a second and finally gives output in the form of information. The figure 3.1 shows the different categories of input devices.

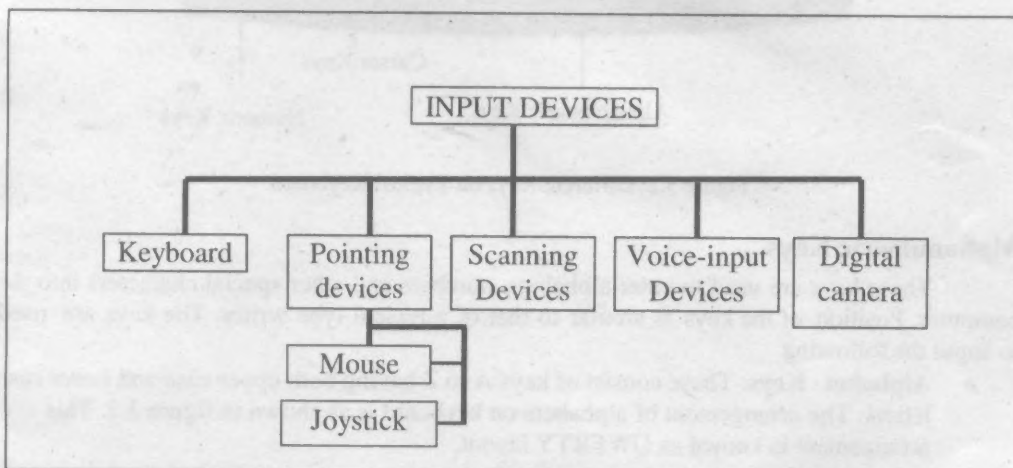


Figure 3.1: Categories of input devices

3.1.1 Keyboard

Keyboard is the standard input device used to enter textual data into the computer. The layout of keyboard is just like the traditional typewriter. But it contains some extra command keys and function keys. Among the most popular keyboard layout are QWERTY and DVorak. The layout refers to the arrangement of keys on the keyboard. A typical keyboard can have 101 to 104 keys.

The keys on computer keyboards are often classified as follows:

- **Alphanumeric keys:** Alphabets and numbers.
- **Numeric keys:** Numbers and mathematical operators.
- **Function keys:** keys for special functions (F1, F2, F3 F12).
- **Cursor control keys:** Keys that move the cursor (Up, Down, Left, Right).

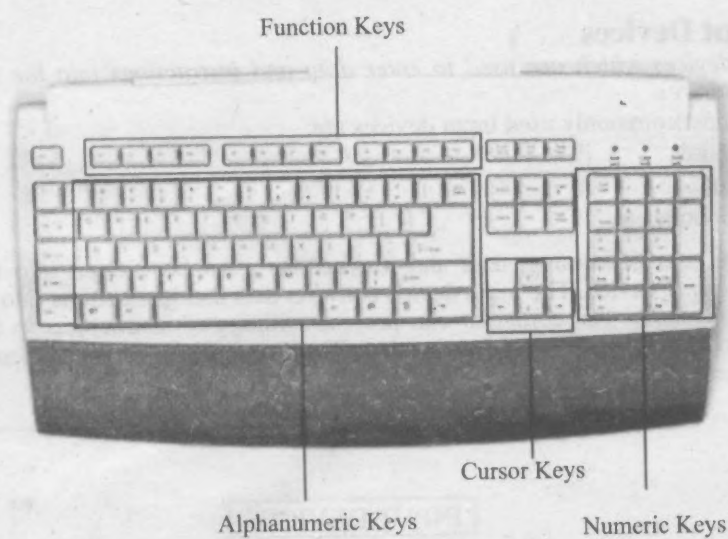


Figure 3.2: Different Keys on Typical Keyboard

Alphanumeric Keys

These keys are used to enter alphabets, numbers and other special characters into the computer. Position of the keys is similar to that of a typical type writer. The keys are used to input the following

- **Alphabet Keys:** These consist of keys A to Z having both upper case and lower case letters. The arrangement of alphabets on keyboard is as shown in figure 3.3. This arrangement is known as QWERTY layout.

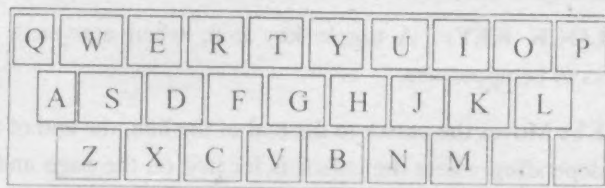


Figure 3.3 : Alphabets Layout on keyboard (QWERTY Layout)

- **Number keys:** These consist of number keys starting from 0 to 9.
- **Special Characters keys:** These consist of punctuation keys, special characters, and space bar.

Numeric Keys

These keys are used to input numbers into the computer. The layout of these keys is similar to that of a typewriter. Alongwith the number keys it also contains keys for mathematical operations i.e, plus, minus, multiply, divide.

Function Keys

Function keys are used to perform different functions depending upon the application or program that is executing. These keys provide shortcuts for doing routine tasks on a computer.

Most computer keyboards have a row of Function keys at the top of the keyboard. These keys are marked from F1 to F12. Many programs, including most of Microsoft's products, support use of the function keys. The function keys are frequently used in combination with other keys such as the CTRL key, the ALT key, and the SHIFT key. This results in a large number of possible keyboard shortcuts.

Cursor Control Keys

Cursor is used to represent the position where the keyboard's input will be placed. These four arrow keys are used for moving the cursor from its current position to *right*, *left*, *up*, or *down*. Moving these cursor keys does not change or delete any characters on the screen. These are also used for screen navigation. The function of some of the other important keys is given below:

ENTER KEY: Used to enter commands or to move the cursor to the beginning of the next line. This is sometimes labeled as *Return* instead of Enter.

ESC KEY: Short for Escape, this key is used to send special codes to devices and to exit (or escape) from programs and tasks.

DELETE KEY: Deletes the character at the current cursor position and the one at right of the cursor position. Also used to delete the selected object, but it does not move the cursor.

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CAPS LOCK KEY: A toggle key that, when activated, causes all alphabetic characters to be uppercase.

END KEY: Moves the cursor to the end of the line, the end of the page, or the end of the file depending where the cursor is located on the page and on which program is running.

CTRL KEY: Short for Control, this key is used in combination with other keys to produce special characters. The meaning of each control character depends on which program is running.

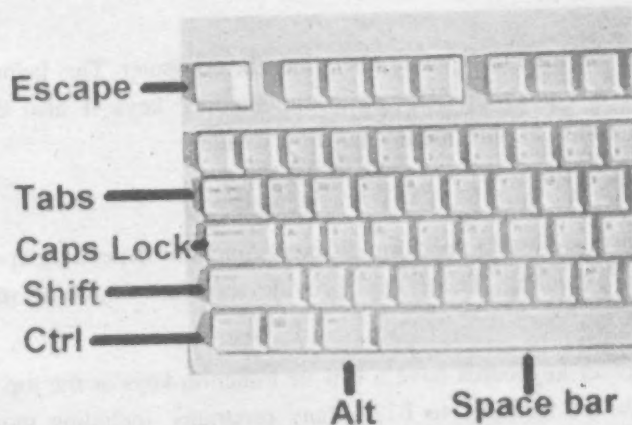


Figure 3.4 : Special Keys on Left Side of keyboard

ALT KEY: Short for Alternate, this key is used in combination with other keys to produce special characters.

TAB: This key enables the cursor to jump a couple of spaces to the right on the screen. To jump the equivalent spaces to the left, Shift-Tab keys should be pressed together.

BACKSPACE KEY: Deletes the character present at the left of the cursor and moves the cursor to that position.

PAGE UP and PAGE DOWN: This is used to move the cursor up or down a certain fixed number of lines usually one page at a time. This is often abbreviated as PgUp and PgDn.

HOME: Moves the cursor to the left corner of the line or to the beginning of the page or file depending where the cursor is and on which program is running.

INSERT: In insert mode, all characters typed are placed at the cursor position (or to the right of the insertion point). With each new insertion, characters to the right of the

cursor are pushed to the right of the insertion point to make room for the new characters. If insert mode is turned off, typing then overwrites existing characters instead of inserting the new ones before the old ones. This is often called overwrite mode. Most PC keyboards have an INSERT key that lets you switch back and forth between insert and overwrite mode.

Space Bar: This key moves the cursor one space to the right every time you press key.

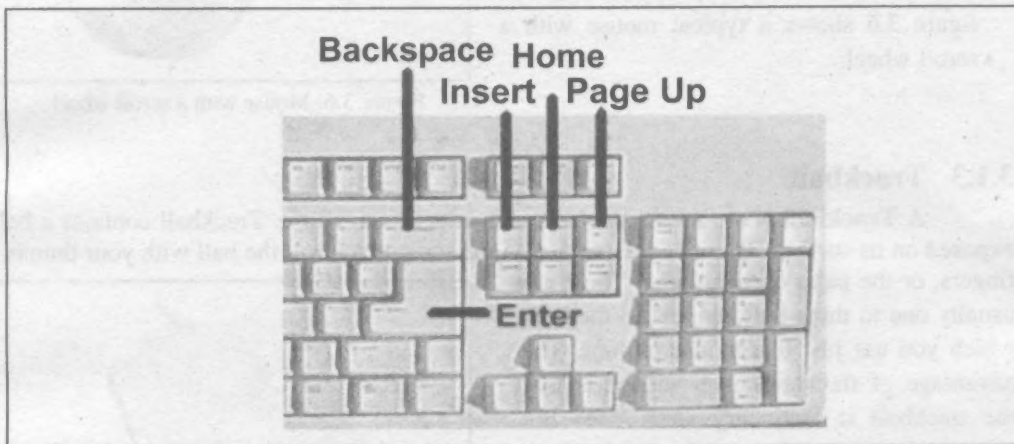


Figure 3.5: Special Keys on right side of keyboard

3.1.2 Mouse

A mouse is an input device that rolls around on a flat surface and controls the pointer on a display screen. The pointer is an on-screen object – usually an arrow – that is used to select text; access menus; and interact with programs, files or data that appear on screen. As you move the mouse, the pointer on the display screen moves in the same direction. A typical mouse has two buttons, which perform different functions depending on what application is running. Some mice also include a scroll wheel for scrolling through long documents.

Optical mouse is getting popular nowadays; instead of having a roller ball it uses light reflection to control the movement of pointer on the screen.

Mouse Events:

Mouse event refers to the activity that can be performed by using the mouse. A typical mouse can perform the following events:

- Left Click
- Right Click
- Drag

Left Click is used to select a graphical object such as a file icon and a piece of text in a document etc., or to press a button such as the start button and closing, opening or minimizing a window etc.

Right Click is used to view the properties of an object such as file, folder, desktop etc.

Drag event triggers when you keep on pressing the left mouse button while moving the mouse. This event is used to select more than one items at a time, or to drop an object into another application. The figure 3.6 shows a typical mouse with a scroll wheel.

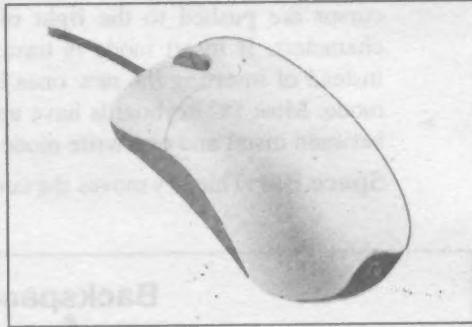


Figure 3.6: Mouse with a scroll wheel

3.1.3 Trackball

A **Trackball** is a pointing device that works like a mouse. Trackball contains a ball exposed on its surface. To move the pointer on the screen, you roll the ball with your thumb, fingers, or the palm of your hand. There are usually one to three buttons next to the ball, which you use just like mouse buttons. The advantage of trackballs over mouse is that the trackball is stationary so it does not require much space for use. In addition, you can place a trackball on any type of surface. For both these reasons, trackballs are popular pointing devices for portable computers.

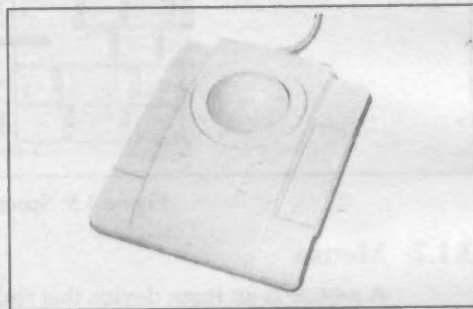


Figure 3.7: A Typical Trackball

3.1.4 Joystick

Joystick is an input device used for games, computer aided designs or simulations. It is like a lever that moves in all directions and controls the movement of a pointer or some other display symbol. A joystick is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse. With a joystick, the pointer continues moving in the direction the joystick is pointing. To stop the pointer, you must return the joystick to its neutral position. Most joysticks include two buttons called triggers.



Figure 3.8: Joystick

3.1.5 Scanner

A **scanner** is an input device which is capable of reading the image present on a piece of paper and transferring the information into a computer where a program can store and interpret it. This information is in the form of a graphic image or picture and not in the form of text. Even if the paper contains text, the information transferred is not text but a picture of text. Optical Character Recognition (OCR) software is necessary to read this image and convert it to actual text data and this software varies widely in its ability to do so. Scanners range from monochrome (2 color) scanners to flatbed scanners and color scanners capable of scanning a whole page at once and costing several thousand rupees.

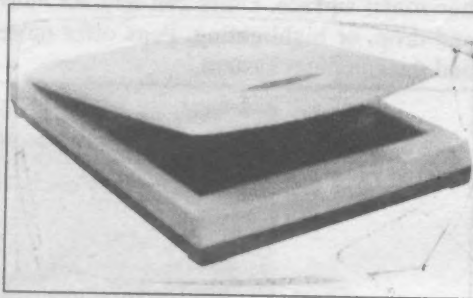


Figure3.9: Scanner with open top cover

3.1.6 Microphone

A **microphone** is an input device used to digitally record audio data, such as the human voice. It can be plugged into a computer or recorder. Many productivity applications can accept input via a microphone, enabling the user to dictate text or issue commands orally. Software in the computer converts the sound impulses into digital form. It is then stored in memory and processed when required.

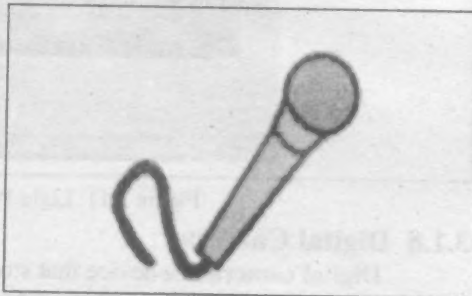


Figure 3.10: Typical Microphone

Voice Recognition

A **voice-recognition** system, using a microphone as an input device, converts a person's speech into digital data by comparing the electrical patterns produced by the speaker's voice with a set of prerecorded patterns stored in the computer.

Voice Recognition allows a user to use his voice as input. Voice recognition may be used to dictate text to the computer or to give commands to the computer such as opening application programs, pulling down menus, or saving work.

Older voice recognition applications require each word to be separated by a distinct pause. This allows the machine to determine where one word begins and the next stops. This style of dictation is called *discrete speech*. Many people prefer these systems to the newer continuous speech.

3.1.7 Light Pen

Light pen is a light-sensitive input device shaped like a pen. It is used to draw on the computer screen or to make menu selection. As the tip of the light pen makes contact with the

screen, it sends a signal back to the computer containing the x-y coordinates of the point. Light pens can be used on any size screen.

Light pens give the user the full range of mouse capabilities, without the use of any horizontal surface. Users can interact more with the application, using options such as drag and drop, or highlighting. Pens offer more active and accurate interaction between the user and the computer system.

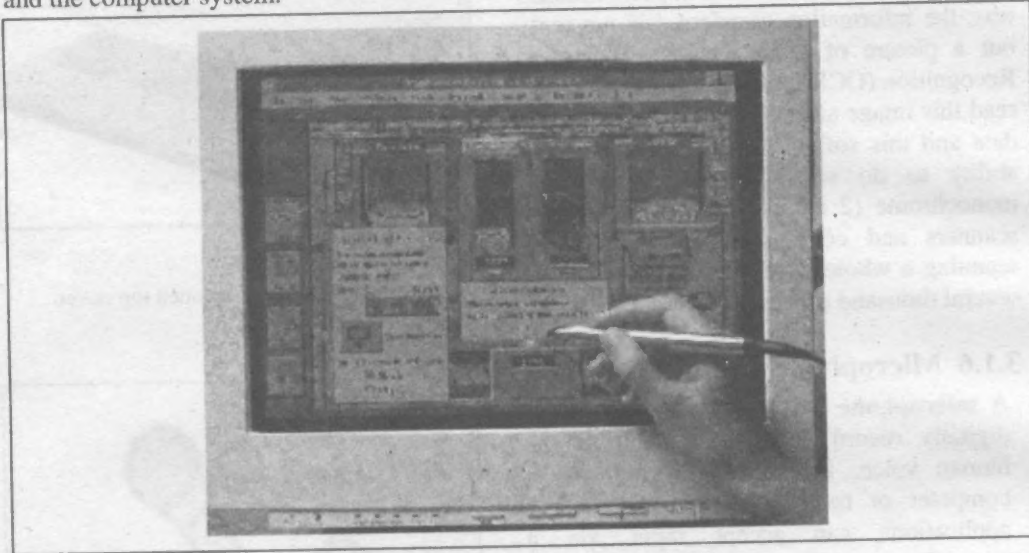


Figure 3.11: Light Pen used on a graphic display

3.1.8 Digital Camera

Digital camera is a device that stores images digitally in its memory rather recording them on film. Once a picture has been taken, it can be downloaded to a computer system, and then manipulated with a graphics program and printed. Digital photos are limited by the amount of memory in the camera and by the quality of the final output device.

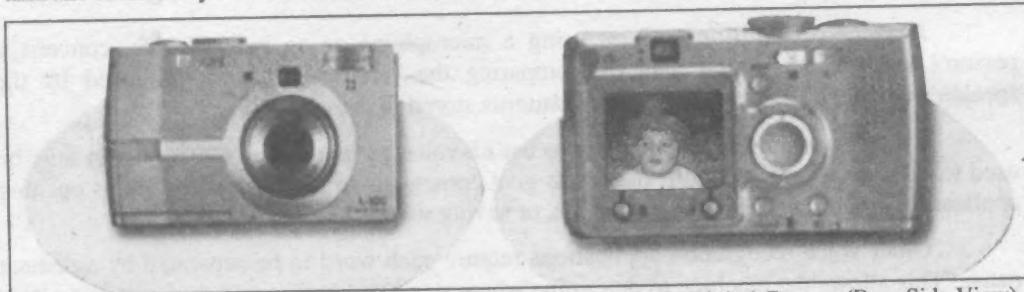


Figure 3.12: Digital Camera (Front Side view)

Figure 3.13: Digital Camera (Rear Side View)

The big advantage of digital cameras is that making photos is both inexpensive and fast because there is no film processing involved.

3.1.9 Disk Drive

A **disk drive** is a machine that reads data from and writes data onto a disk. Disk drive rotates the disk with precise timing and has one or more read/write heads that read and write

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data. The data is read by the read/write head and transferred to the computer's main memory for further processing. There are different types of disk drives for different types of disks e.g., a *hard disk drive* (HDD) reads and writes hard disks, and a *floppy disk drive* (FDD) accesses floppy disks, and an *optical disk drive* reads optical disk. Disk drives can be either *internal* (housed within the computer) or *external* (housed in a separate box that connects to the computer).

3.2 Output Devices

The devices which are used to receive data and information from the computer are called output devices.

The most commonly used output devices are:

- Monitor
- Printer
- Speaker etc.

Before going into details of output devices it is necessary to discuss two basic concepts related to input/output devices i.e. hard copy and soft copy. An electronic version of a document stored (normally as a file) on a storage device is called **soft copy**, whereas the printed version of an electronic document (on a paper) is called **hard copy**. Here is a brief discussion on commonly used output devices.

Remember that:

There are some devices which act as both input and output devices e.g. touch screen, hard disk drive, floppy disk drive etc.

3.2.1 Monitor

The **monitor** is the most commonly used output device on personal computers (PCs). It is also called a display or a screen. You look at your monitor whether you are typing, issuing commands, surfing the Internet, or even listening to music. The quality of the image on the screen depends upon many factors. **Resolution** is one of the factors affecting the quality of the monitor. The *resolution* of a monitor refers to the number of pixels on the screen, expressed as a matrix.

All the monitors can be categorized by the way they display colors. These are monochrome monitors and color monitors. *Monochrome monitors* can display only one color (such as green, amber or white) against a contrasting background, which is usually black. These monitors can display text only and are not used for displaying graphics. *Color monitors* display combinations of red, green and blue colors. These three are the basic colors and their combination can display a full range of colors.

TYPES OF MONITOR

There are two basic types of monitors. These are

- CRT (cathode rays tube) monitor
- Flat panel monitor

CRT MONITOR

A CRT monitor consists of a phosphorus coated screen; there are three electron guns on its back. The screen's phosphor coating is organized into a grid of dots. The smallest number of phosphor dots that the gun can focus on is called a **pixel** or **picture element**.

The three electron guns emit beams of three different colors i.e. red, green and blue. In color monitors each pixel include three phosphors – red, green, and blue – arranged in a triangle. When the beams of each of these guns are combined and focused on a pixel, the phosphors lights up. The monitor can display different colors by combining various intensities of the three beams.

A CRT monitor contains a **shadow mask**, which is a fine mesh made up of metal, fitted to the shape and size of the screen. The holes in the shadow mask's mesh are used to align the electron beams, to ensure that they strike precisely the correct phosphor dot. In most shadow masks, these holes are arranged in triangle.



Figure 3.14: A CRT Monitor

FLAT-PANEL MONITOR

Flat panel monitors are usually used in portable computers and laptops because of their small size. They are expensive to manufacture and don't provide the high quality and bright colors that CRT technology provides. There are several types of flat-panel monitors but the most common is liquid crystal display (LCD) monitor.

LCD monitors create images with a special kind of liquid crystal that is normally transparent but becomes opaque when charged with electricity. If you have a handheld calculator or a digital watch, it probably uses a liquid crystal display.



Figure 3.15: Typical LCD Screen

VIDEO CONTROLLER

The quality of the images that a monitor can display is defined as much by the **video controller** as by the monitor itself. Video controller is an intermediary device between the CPU and the monitor. It contains memory and circuitry necessary to send information to the monitor for display on screen. The resolution of the monitor is actually determined by the video controller, not by the monitor itself e.g. Video Graphic Array (VGA) has resolution 640 x 480 pixels, Super Video Graphic Array (SVGA) has resolution 1024 x 768 etc.

3.2.2 Printer

A *printer* is a device that produces hardcopy on the paper. Printers are commonly used in businesses to get the documents printed on paper. Depending upon the printing mechanism used, printers fall into two categories i.e.

- Impact printers
- Non impact printers

IMPACT PRINTERS

An **impact printer** produces images by striking an inked ribbon with a hammer or a set of pins, pressing ink from the ribbon onto a piece of paper.

Impact printers are the oldest print technologies which are still in production. Some of the largest printer companies continue to manufacture, sell, and support impact printers. Impact printers are most useful in specialized environments where low-cost printing is required. The three most common forms of impact printers are:

- Dot-Matrix Printer
- Daisy-Wheel Printer
- Line Printer

Dot-Matrix Printer produces characters by striking pins against an ink ribbon to print closely spaced dots in the appropriate shape. The shape forms a number, alphabet or other special characters. Dot-matrix printers are relatively expensive and do not produce high-quality output; however, they can print multiple copies of a page at a time.



Figure 3.16: Dot Matrix Printer



Figure 3.17: Daisy Wheel Printer

Daisy-wheel Printer has characters etched at the outer edge of a pedaled wheel (hence the name daisy wheel) which forms characters in the same way as a typewriter. Daisy-wheel printers are loud and slow. They cannot print graphics, and cannot change fonts unless the print wheel is physically replaced. With the advent of laser printers, daisy-wheel printers are generally not used in modern computing environments.

Line Printer is somewhat similar to the daisy-wheel is the line printer. Line printers have a mechanism that allows multiple characters to be simultaneously printed on the same line. Line printer has speeds ranging from 300 LPM (lines per minute) to 2400 LPM.

Because of the nature of the print mechanism, line printers are much faster than dot-matrix or daisy-wheel printers; however, they tend to be quite loud, have limited font capability, and often produce lower print quality than recent printing technologies.

Because line printers are used for their speed, they use special paper with pre-punched holes along each side. This arrangement helps to continue printing at high speed till the paper runs out.



Figure 3.18: Line Printer

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NON-IMPACT PRINTER

A **non-impact printer** produces images on paper without striking the page in any way.

There are several types of non-impact printers called thermal and electrostatic printers. These printers use a chemically coated paper on which the characters are exposed by some means such as a laser. This means that these printers can produce a printed image without striking the paper. Because the printing device is simple and has no moving parts, these printers are inexpensive to manufacture and silent. Very fast non-impact printers are capable of printing more than 24 pages per minute. Different kinds of non-impact printers are explained below.

LASER PRINTER

Laser stands for Light Amplification by Stimulated Emission of Radiations. Laser printers are similar to copy machines. They use laser beams to burn special ink called toner on the page to create a permanent image. They create high-quality output at a relatively fast speed, without making too much noise.

Basically laser printers apply an electrostatic charge to a drum inside the printer cartridge. A laser or a light-emitting diode then discharges portions of the drum to form the characters or graphics. Charged toner attaches itself to these discharged sections. A charged piece of paper is passed over the drum, transferring the toner. The toner is heated and adhered to the sheet.

Laser printers have speeds of 4, 8, 12, or more pages per minute. These speeds can vary depending on whether you are printing plain text, or images.



Figure 3.19: Laser Printer

ELECTRO-THERMAL PRINTER

An electro-thermal printer is a type of printer that uses heated pins to "burn" images onto heat-sensitive paper. These types of printers are commonly used in calculators and fax machines. They are inexpensive and print relatively fast but produce low resolution prints.

ELECTROSTATIC PRINTER

Electrostatic printers use a special photographic paper that allows characters to be etched onto the paper using a stylus. The stylus is made up of tiny wires and forms characters by placing an electrostatic charged image on the paper. Then, as the paper is moved through a solution containing ink particles, the ink adheres to the charges that form a pattern on the paper to develop the image. This type of printer can be used for both printing and plotting (displaying graphic output), and can print more than 5,000 lines per minute.

INK JET PRINTER

Ink-jet printer is a type of printer that works by spraying ink on a sheet of paper. Magnetized plates in the path direct the ink onto the paper in the desired shapes. Ink-jet printers are Capable of producing high quality print that are produced by laser printers. A typical ink-jet printer provides a resolution of 300 dots per inch, although some newer models offer higher resolutions. These printers can also produce high quality color graphics including photos.

In general, the price of ink-jet printers is lower than that of laser printers. However, they are considerably slower. Another drawback of ink-jet printers is that they require a special type of ink

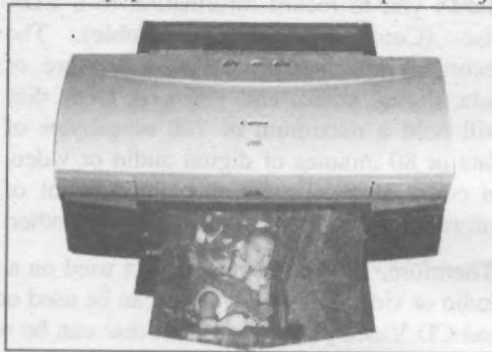


Figure 3.20: Ink Jet Printer

3.2.3 Plotter

A **plotter** is a large scale printer that receives commands from a computer to make drawings on the paper with one or more automatic pens. Unlike a regular printer, the plotter can draw continuous point-to-point lines directly from computer graphics files or commands. There are three basic types of plotters, i.e.,

- Drum plotters
- Flatbed plotters
- Electrostatic plotters

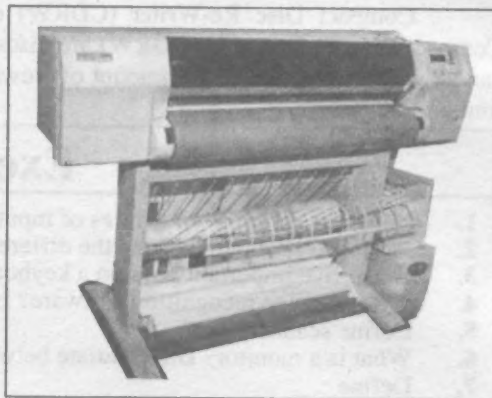


Figure 3.21: Plotter

DRUM PLOTTER

The printing mechanism of the **drum plotter** involves a pen and a drum. The paper is wrapped onto the drum that rotates back and forth. To produce an image onto the paper, the pen (mounted on a cartridge) moves horizontally while the rotation of drum causes the paper to move vertically. In this way the vertical movement of the paper and the horizontal movement of the pen create the required design. Pen having different colors can be used to produce output in different colors.

FLATBED PLOTTER

The printing mechanism of **flatbed plotters** consists of two arms and a rectangular flatbed. Flatbed plotters use two arms, each of which holds a set of colored ink pens. The two arms operate at right angle as they draw on a stationary piece of paper. Flatbed plotters are very slow and even can take hours to print a complicated drawing.

ELECTROSTATIC PLOTTER

Electrostatic Plotter draws on negatively charged paper with positively charged toner. As a rule, plotters are much more expensive than printers. They are most frequently used for CAE (Computer-Aided Engineering) applications, such as CAD (Computer-Aided Design) and CAM (Computer-Aided Manufacturing).

COMPACT DISK-RECORDABLE / RE-WRITABLE (CD-R/CD-RW)

A CD-Recordable (CD Writer) is a drive that allows you to record information to a CDR disc (Compact Disk Recordable). The recorded information can be a mixture of data, digital audio, and video. A CDR disc will hold a maximum of 700 megabytes of data or 80 minutes of digital audio or video. In cases of mixing formats, the amount of information is proportional to each other.

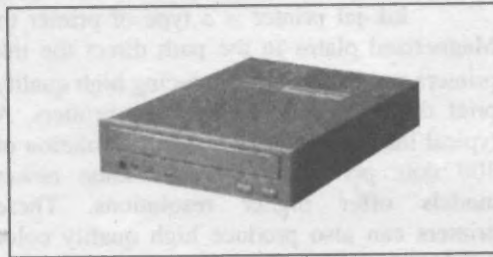


Figure 3.22: Compact Disc Re-Writer (CDRW) drives

Therefore, 350 megabytes of data used on a disc means that you have 40 minutes of digital audio or video left. CDR discs can be used on almost any CD-ROM drive, CD Audio player, and CD Video player. A CDR disc can be written to only once and can not be deleted once it has been recorded. There are ways of writing information in parts, also known as multi-session.

Compact Disc Re-Writer (CDRW) drives can use both CDR and CDRW discs. Compact Disc Re-Writable (CDRW) are discs on which old data can be erased and new data can be written. Normally, the amount of "rewrites" that you can do on a CDRW disc is 1000 times.

Exercise

1. Name the different categories of input devices.
2. What is a keyboard? Name the different key categories on the keyboard.
3. Name five important keys on a keyboard along with their functions.
4. What is voice recognition software? Explain.
5. Define scanners.
6. What is a monitor? Differentiate between monochrome and color monitors.
7. Define
 - a. Flat Panel Display
 - b. Liquid Panel Display
8. Write a note on different kinds of printers.
9. What is a plotter?
10. What is the difference between soft copy and hard copy?
11. Fill in the blanks:
 - (i) A _____ is the most commonly used input device that enables you to enter data into a computer.
 - (ii) _____ keys are used to enter alphabets, numbers and other special characters into the computer.
 - (iii) _____ keys are used to input numbers into the computer.
 - (iv) _____ is an optical disc used for storing digital data.
 - (v) _____ used to store large quantities of data inexpensively and therefore are often used for backup.
 - (vi) QWERTY is a _____.
 - (vii) Color monitor uses _____, _____ and _____ colors to display a colored picture.
 - (viii) Scanner is a(n) _____.
 - (ix) LASER stands for _____.
 - (x) CD can store more than _____ data.

12. Mark as true or false.

- (i) Mouse allows the user to control the movement of the cursor or pointer on a display screen.
- (ii) Joystick is an input device used for games, computer aided designs or flight simulators.
- (iii) A scanner is an input device which is capable of reading the image present on a piece of paper and transferring the information into a computer where a program can store and interpret it.
- (iv) Trackball is an output device.
- (v) Monochrome monitors can display all the colors.
- (vi) Touch Screen is an input as well as output device.
- (vii) Hard disk is a sequential access device.
- (viii) Magnetic tape is normally used to take backup of data.
- (ix) Impact printers don't touch the surface of paper during printing.
- (x) Mouse is the primary (input) device.

13. Choose the correct answer.

- (i) Which of the following is not an input device?
a. Magnetic tape units b. Floppy disk drive units
c. Monitor d. Keyboard e. Mouse
- (ii) The keys on computer keyboards are often classified as follows:
a. Alphanumeric keys b. Numeric keys c. Function keys
d. Cursor control keys e. All of the above
- (iii) Which printer uses laser beams to burn special ink called toner on the page to create a permanent character?
a. Dot matrix b. Daisy wheel c. Laser d. Ink Jet e. Plotter
- (vi) Flat panel displays are usually used in
a. Supercomputer b. Personal Computers c. Portable Computers / Laptops
d. All of the above e. None of the above
- (v) Hard disk is a _____ disk that stores data.
a. Optical b. Magnetic c. Random Access d. Read only f. None of the above

Answers**Q.11**

- | | | | |
|---|------------------------|------------------------|--------------|
| (i) Keyboard | (ii) Alphanumeric keys | (iii) Numeric keys | (iv) CD-ROM |
| (v) Magnetic Tape | (vi) Keyboard layout | (vii) Red, Green, Blue | (viii) Input |
| (ix) Light Amplification by stimulated emission of radiations | | (x) 700 MB | |

Q.12

- | | | | | |
|--------|---------|----------|--------|-------|
| (i) T | (ii) T | (iii) T | (iv) F | (v) F |
| (vi) T | (vii) F | (viii) T | (ix) T | (x) F |

Q.13

- | | | | | |
|-------|--------|---------|--------|-------|
| (i) c | (ii) e | (iii) c | (iv) c | (v) b |
|-------|--------|---------|--------|-------|